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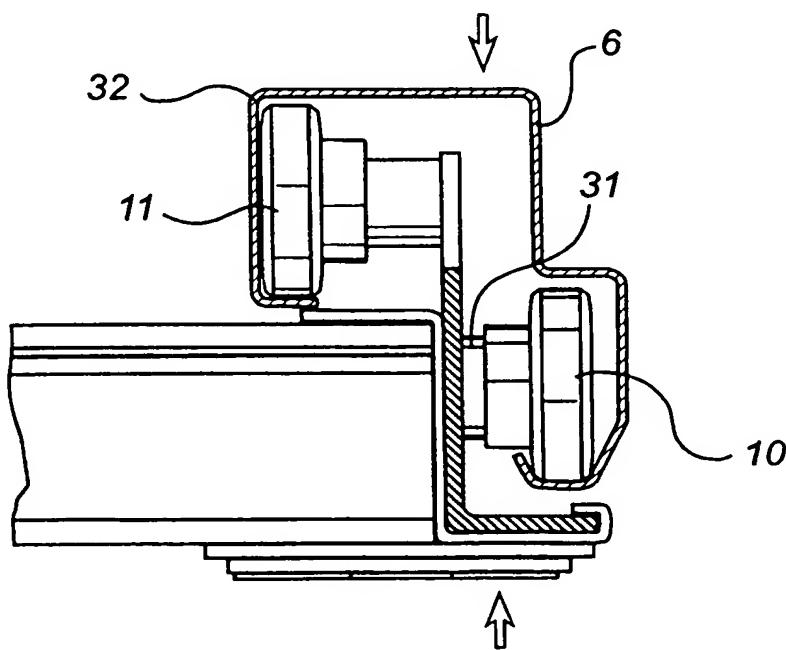
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(54) Title: DEVICE IN DOOR ARRANGEMENT



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means (30).

(57) Abstract: A device in an overhead sliding door, which comprises guide rails (4) extending along the vertical sides of a door opening and a door panel (1) comprised of a number of door-panel sections (3), said door-panel sections being hingedly interconnected via horizontal pivot joints (2) and supporting runners (10) at the lateral edges of the door panel, which runners are guided along the guide rails (4). The respective upper parts of said rails pass into a bend (5) and continue as an essentially horizontally extending guide rail (6). The overhead sliding door has at least either a drive or a balancing device (8), which is connected with the door panel (1) via at least one traction means (30). The essentially horizontally extending guide rail (6) comprises two tracks, a first one of said tracks receiving a top runner (11) disposed in the top section of the door panel (1) and a second one of said tracks receiving the runners (10) disposed in the remaining sections of the door panel (1). The tracks are located one on each side of the traction

DEVICE IN DOOR ARRANGEMENTTechnical Field of Invention

The present invention relates to a device in overhead sliding doors comprising guide rails extending along the vertical sides of a door opening and a door panel 5 comprised of a number of door-panel sections, said door-panel sections being hingedly interconnected via horizontal pivot joints and supporting runners at the lateral edges of the door panel, which runners are guided along the guide rails, the respective upper parts of said rails 10 forming a bend and continuing as an essentially horizontally extending guide rail.

Technical Background of the Invention

An overhead sliding door of the kind defined in the 15 introduction is previously known from e.g. SE 505 815. Doors of this kind usually comprise guide rails wherein a runner, for example in the shape of a roller, is received so as to travel in a track devised for that purpose. The roller in turn is carried by a support, which is connected with the door panel. In prior-art overhead sliding doors, the guide-rail tracks therefore are open along a slit, at least in the direction of the roller support mouth for engagement with the door. The reason therefor is to allow the sliding door to be displaced backwards 20 and forwards along the guide rail to open and close the garage door. 25

The open slit formed in the tracks in combination with the rollers arranged for sliding motion therein are potential causes of serious clamping injuries, particu-

larly when the door is being opening and closed, the reason therefore being the existence of numerous passages, along which the moving unprotected rollers are freely accessible. Sliding doors are comparatively heavy and they 5 are hazardous to persons nearby inasmuch as they may inflict serious bodily clamping injuries owing to their considerable mass. The tracks often are designed to offer good roller fit and comparatively serious clamping incidents therefore may occur, should a moving roller come 10 into contact with e.g. a person's fingers.

In order to make the overhead sliding door light-weight and easy to manage when being raised and lowered, doors of this kind often are provided with wires, which are resiliently connected with a balancing spring and 15 which preferably are arranged symmetrically in engagement with the door, each at its respective lower corner of the door. From there, the wires extend vertically along the side edges of the door until they reach the balancing spring.

20 An additional problem found in prior-art devices is that the guide rail wherein the door panel slides, forms a curved track at the upper edge of the door opening, in which track the rollers that are connected with the door engage. The reason for the curved configuration of the 25 track is to enhance smoothness of door movement upon opening and closing of the door. In order to enable the top panel section of the door to still reach out to a position adjacent to the upper part of the door opening the runners that from opposite directions are connected with 30 the uppermost part of said top panel section, are disposed in separate tracks guiding precisely these runners all the way up to the associated upper side corners of the door opening. Since the balancing spring is compara-

tively bulky, it preferably is disposed further inwards relative to the door opening in order for the spring to be clear of external walls and the like.

In turn, this arrangement means that the runner  
5 holders supporting the runners in their separate tracks as described above, tend to hook onto the traction means when the door is nearing its closed position, because the wire often encroaches on the area that the runner and its holder necessarily have to pass. As is appreciated, this  
10 impedes the desired raising and lowering of the overhead sliding door. The user is then forced to manually loosen the wire from one of the runner devices, and this in a situation, which as described above involves increased risks of clamping injuries.

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#### Summary of the Invention

The object of the present invention therefore is to provide an overhead sliding door arranged to minimise the risk of clamping injuries, particularly in conjunction  
20 with opening and closing of the door. Another object of the present invention is to provide a robust and safe high-quality overhead sliding door.

Another object of the present invention is to provide an overhead sliding door arranged to ensure that the overhead sliding door may be opened and closed in a simple manner without hooking onto the traction means that extend between the balancing means and the lower part of the overhead sliding door on either side of said door.

These objects are achieved in according with the  
30 teachings of the invention in that the device of the kind outlined in the introduction exhibits the characterising features defined in the appended claim 1. Preferred embodiments are defined in the dependent claims 2-11.

The inventive device in an overhead sliding door comprises guide rails extending along the vertical sides of a door opening and a door panel comprised of a number of door-panel sections, said door-panel sections being 5 hingedly interconnected via horizontal pivot joints and supporting runners at the lateral edges of the door panel, which runners are guided along the guide rails, the respective upper parts of said rails passing into a bend and continuing as an essentially horizontally ex- 10 tending guide rail, and having at least either a drive or a balancing device, which is connected with the door panel via at least one traction means. The essentially horizontally extending guide rail comprises two tracks, a first one of said tracks receiving a top runner disposed 15 in the top section of the door panel and a second one of said tracks receiving the runners disposed in the remaining sections of the door panel, said tracks located one on each side of the traction means.

This solution offers several advantages, such as 20 minimising clamping- injury hazards in the area between for example the runners and the guide rail and between the lateral edge of any one of the door-panel sections and the guide rails, particularly in conjunction with closing and opening of the door. The device in accordance 25 with the invention provides free passage past the traction means as the door is nearing its closing position. In addition, the inventive device offers a higher degree of freedom as concerns choice of traction means extension and positioning relative to the runners and the door 30 structure. The invention makes it possible to essentially encapsulate the runners and the respective tracks in which the runners are received without making sliding movements of the overhead sliding door more difficult.

According to a particularly preferred embodiment of the invention, compared with the top runner the runners are directed in the opposite direction to their associated carriers and to said top runner. This arrangement of 5 the respective runners allows these components to be suitably encapsulated by means of a comparatively simple profiled section. The device in accordance with the invention comprises a profiled section in which the tracks are integrated. In the profiled section, which serves as 10 a guide rail, the runners may slide backwards and forwards. The profiled section preferably is arranged as a covering guard. The reason for this arrangement is to prevent access to the tracks and the runners from the outside, which reduces the clamping-injury risks. In addition, the integrated profiled section prevents dirt and 15 waste matter from entering the guide-rail tracks and hamper runner movement along the tracks.

Suitably, the separate tracks extend in the essentially horizontal guide rail in parallel relationship. As 20 a result, the overhead sliding door runs smoothly and evenly when opened and closed. Preferably, the balancing device is arranged on the overhead sliding door in the form of a balancing spring located closely adjacent to the top of the door opening. Also other varieties of resilient attachment as well as means for deflecting the 25 traction means obviously are possible and may be used to replace the balancing spring in the embodiments of the invention to be described further on. The configuration of the individual door opening largely determines the possibilities of finding enough space to locate the balancing spring in the desired place and of obtaining maximum door opening height.

In accordance with one embodiment of the invention, the traction means are attached at their other end to their respective one of the door panel sides, preferably at the lower part thereof. Preferably, the traction means 5 are of wire, chain, belt or cog drive-belt type.

In accordance with one embodiment of the invention, the separate tracks formed in the essentially horizontally extending guide rail are arranged in mutually parallel and laterally displaced relationship, an arrangement that forms a horizontal space in the area between the runners inside the tracks essentially perpendicularly to the axial direction of the tracks. Owing to this inventive arrangement, free passage past the traction means is obtained when the door panel is nearing its closing 10 position.

This is achieved because said traction means run in the area formed between said tracks. In accordance with the invention, the runners comprise rollers. This arrangement ensures even, low-friction movement of the runners in accordance with the invention. In accordance with 20 an alternative embodiment of the invention, the runners comprise slide means. Obviously, also the runners in accordance with one embodiment may comprise rollers as well as slide means, which preferably are positioned in mutually different places on the door panel.

Obviously, it lies within the scope of the invention to combine freely the embodiments as also the different steps of the inventive method. It should also be appreciated that a lifting means could be arranged in the 30 overhead sliding door in order to provide a lifting force, thus avoiding that the opening and closing movements are felt to be heavy. The lifting means preferably is associated with some kind of power supply. In accor-

dance with one embodiment of the invention, the opening and closing movements are automated and may be controlled from a control panel.

##### 5 Brief Description of the Drawings

The invention will be described in the following in more detail by means of one embodiment with reference to the accompanying drawings. In the drawings:

10 Fig 1 is a perspective view of an overhead sliding door designed with the encapsulated rail in accordance with present embodiment of the invention as seen from the inside of a space having a door opening.

15 Figs 2a-2b are schematic views of two different steps of a door sliding sequence, Fig 2b representing the closed position of the overhead sliding door and Fig 2a a slightly more open position.

20 Fig 3 is a cross-sectional view of the device in accordance with the invention, the section being taken along line III-III of Fig 1 and the door panel assuming a raised position.

Fig 4 is a cross-sectional view of the guide rail, the section being taken along line IV-IV of Fig 1 and the door assuming a lifted position.

25 Fig 5 is a cross-sectional view of the vertical guide rail, the section being taken along line V-V of Fig 2a.

Fig 6 is a perspective view of an essentially horizontally extending guide rail in accordance with the invention.

Detailed Description of Preferred Embodiments

A preferred embodiment of the invention will be described in the following. The examples described should not be regarded as restricting but merely as examples.

5 Fig 1 illustrates an essentially conventional overhead sliding door consisting of a door panel, generally designated by reference 1 and divided into a number of door-panel sections 3, which are hingedly joined together along horizontal pivot elements 2. The number of door-  
10 panel sections depends on the height of the door opening for which the overhead sliding door is intended. At each one of the vertical side edges of the door opening extends a vertical guide rail portion 4. The door-panel sections 3 are connected with and guided by the guide  
15 rails via runners, which preferably are rollers disposed in said rails, said rollers being mounted on shafts attached to the door-panel sections. The weight of the door is balanced by means of a balancing spring 8. Numeral reference 9 designates a drive means designed to actuate  
20 the door panel for movement between a raised open position and a lowered closed position, in which latter position the door panel covers said door opening (not shown in the drawing).

Figs 2a-2b schematically shows the curved track 5  
25 that the guide rail 4, in which the door panel 1 is received for sliding movement, forms at the top edge of the door opening, and in which track engage the runners 10 that are connected with the door panel 1. The reason for the curvature of the track is to enhance door movement  
30 flexibility and smoothness as the door is being opened and closed. In order to enable the top door-panel section A of the door panel 1 to still reach out to a position adjacent the upper part of the door opening the runners

10 that from opposite directions are connected with the uppermost part of said top door-panel section A, are disposed in separate first tracks in the essentially horizontal guide rail 6 that guides precisely said top runner 5 all the way up to the respective one of the upper side corners of the door opening. In a cross-sectional lateral view of one of the two guide rails, Figs 2a-2b show in a simplified manner how this mounting arrangement functions. The balancing device 8 may be designed in several 10 different ways. It could for instance be designed as a wire drum. In Figs 2a and 2b a dotted line suggests an alternative balancing device in the form of a tension spring 33, which co-operates with the traction means 30 via a deflection means. Other varieties of balancing 15 springs 8, not shown herein, are likewise possible within the scope of the invention.

The traction means 30 preferably is arranged so as to intersect and cross the path of the top runner, when the door panel is moving close to its closed position. To 20 illustrate this situation, Fig 2a shows the position of the top runner in a first track of the guide rail 6, when the door opening is slightly open. In Fig 2b is shown the position of the top runner in a first track of the guide rail 6, when the door opening is closed.

25 Fig 3 shows a preferred embodiment of the invention in a cross-sectional view along line III-III of Fig 1. The essentially horizontal guide rail comprises two tracks, in which a top runner is received for sliding movement in the axial direction of the guide rail 6, i.e. 30 essentially perpendicularly to the cross-section of the drawing figure.

Fig 4 illustrates a preferred embodiment of the invention in a cross-sectional view. The essentially hori-

zontal guide rail comprises two tracks in which a top runner 10 is received for sliding movement in the axial direction of the guide rail 6, i.e. essentially perpendicularly to the plan of the cross-section of the drawing figure. Fig 4 shows that in accordance with a preferred embodiment of the invention, the runners 10 received in the second track are laterally displaced relative to the top runner.

In accordance with a preferred embodiment of the invention, the separate tracks in the essentially horizontally extending guide rail 6 are arranged in parallel, in laterally displaced relationship, an arrangement that forms a horizontal space between the runners 10 in the tracks in the crosswise direction of the area between the runners 10 in the tracks, said space indicated by arrows in Figs 3 and 4. Owing to the inventive device, the top runners in the first track are allowed free passage past the traction means 30 as the door panel is nearing its closed position. Since the cross-sections in Figs 3 and 4 are taken in an area, where the traction means, preferably in the form of a wire, is not present, the area indicated in the drawing figure primarily illustrates the clearance provided by positioning the two tracks in laterally displaced relationship. This arrangement in combination with the fact that the runners 10 arranged in the rest of the door-panel sections are supported by carriers 31, the runners of which are oppositely directed relative to their carriers and compared with said top runners, enables the top runner to pass the traction means with clearance in the near closing position in accordance with a preferred embodiment of the invention. This is achieved by arranging said traction means such that it runs in the area formed between said tracks. Preferably, the traction

means 30 is carried through an aperture formed in the guide rail 6 and further up to the balancing spring 8. Preferably, the traction means is arranged to run in abutment against the supporting part 31 of the runner. In 5 accordance with a preferred embodiment, the guide rail 6 is designed as an integrated profiled section 32 housing the runners and their tracks while at the same time encapsulating these means together with the door-panel side, thus minimising the risk of clamping injuries.

10 In accordance with a preferred embodiment of the invention, Fig 5 shows a cross-sectional view of the vertical guide 4, in which a runner 10 is arranged to be displaced relative to the direction of extension of the track. The runner 10 is supported by a support portion 15 31, which in turn is located in a door-panel section. As the runner 10 moves, the door panel 1 is entrained in the movement relative to the guide rail 4. A corresponding constructions preferably is used in the continued ceiling-mounted rail.

20 Fig 6 shows in a perspective view a preferred embodiment of an integrated profiled section that constitutes the essentially horizontal guide rail. Thus, the invention in accordance with the invention may be produced by extrusion but in accordance with an alternative 25 embodiment, it could be produced by bending or rolling a blank. It should not present any difficulties for the expert in the field to choose suitable materials for the structural components in order to produce the device in accordance with the invention. The profiled section may 30 be composed of several separate parts.

The invention has been described above in the form of various embodiments including some suggestions for alternative embodiments but it should be appreciated that

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it could be modified in a variety of ways without departing from the basic inventive idea. Thus, the device in accordance with the invention obviously could be applied to doors designed differently from the one shown herein.

5

CLAIMS

1. A device in an overhead sliding door, which comprises guide rails (4) extending along the vertical sides 5 of a door opening and a door panel (1) comprised of a number of door-panel sections (3), said door-panel sections being hingedly interconnected via horizontal pivot joints (2) and supporting runners (10) at the lateral edges of the door panel, which runners are guided along 10 the guide rails (4), the respective upper parts of said rails passing into a bend (5) and continuing as an essentially horizontally extending guide rail (6); and having at least either a drive or a balancing device (8), which is connected with the door panel (1) via at least one 15 traction means (30), characterised in that the essentially horizontally extending guide rail (6) comprises two tracks, a first one of said tracks receiving a top runner (11) disposed in the top section of the door panel (1) and a second one of said tracks receiving 20 the runners (10) disposed in the remaining sections of the door panel (1), said tracks located one on each side of the traction means (30).

2. A device in overhead sliding doors as claimed in claim 1, the runners (10) of which compared with the top 25 runner (11) are directed in the opposite direction to their associated carriers and to said top runner.

3. A device in overhead sliding doors as claimed in any one of claims 1-2, wherein the tracks formed in the essentially horizontal guide rail (6) extend essentially 30 in parallel with one another.

4. A device in overhead sliding doors as claimed in any one of claims 1-3, wherein said tracks are integrated in a profiled section (32).

5. A device in overhead sliding doors as claimed in any one of claims 1-4, wherein the traction means is attached to the door panel (1) at each side thereof, preferably at the lower part of said panel.

5 6. A device in overhead sliding doors as claimed in any one of claims 4-5, wherein the separate tracks formed in the essentially horizontally extending guide rail (6) are arranged in mutually parallel and laterally displaced relationship, whereby a horizontal runner-separating 10 space is formed between the runners in the track as seen essentially perpendicularly to the axial direction of the tracks, so that the top runner (11) may pass freely past the traction means (30) in the near closing position of the door panel (1).

15 7. A device in overhead sliding doors as claimed in claim 6, wherein said traction means (30) runs in the space formed between said tracks.

20 8. A device in overhead sliding doors as claimed in any one of claims 4-7, wherein the traction means (30) of the overhead sliding door is a wire-type of traction means.

9. A device as claimed in any one of claims 1-8, wherein said runners (10) comprise rollers.

10. A device as claimed in any one of claims 1-8, 25 wherein said runners (10) comprise sliding means.

11. A device in overhead sliding doors as claimed in any one of claims 1-10, wherein the guide rail (6) forms an engagement-preventing enclosure about the runners (10, 11) and their carriers.

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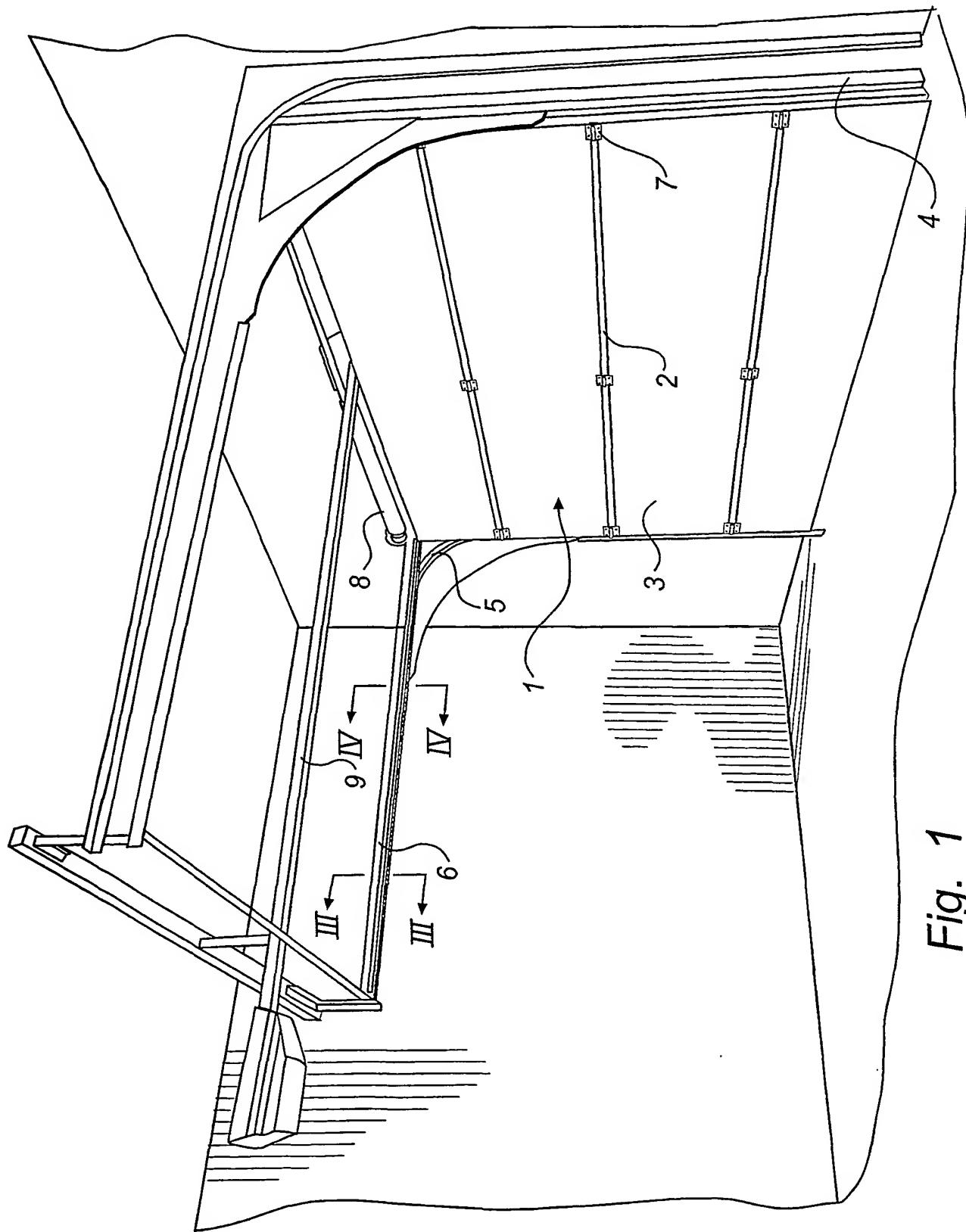


Fig. 1

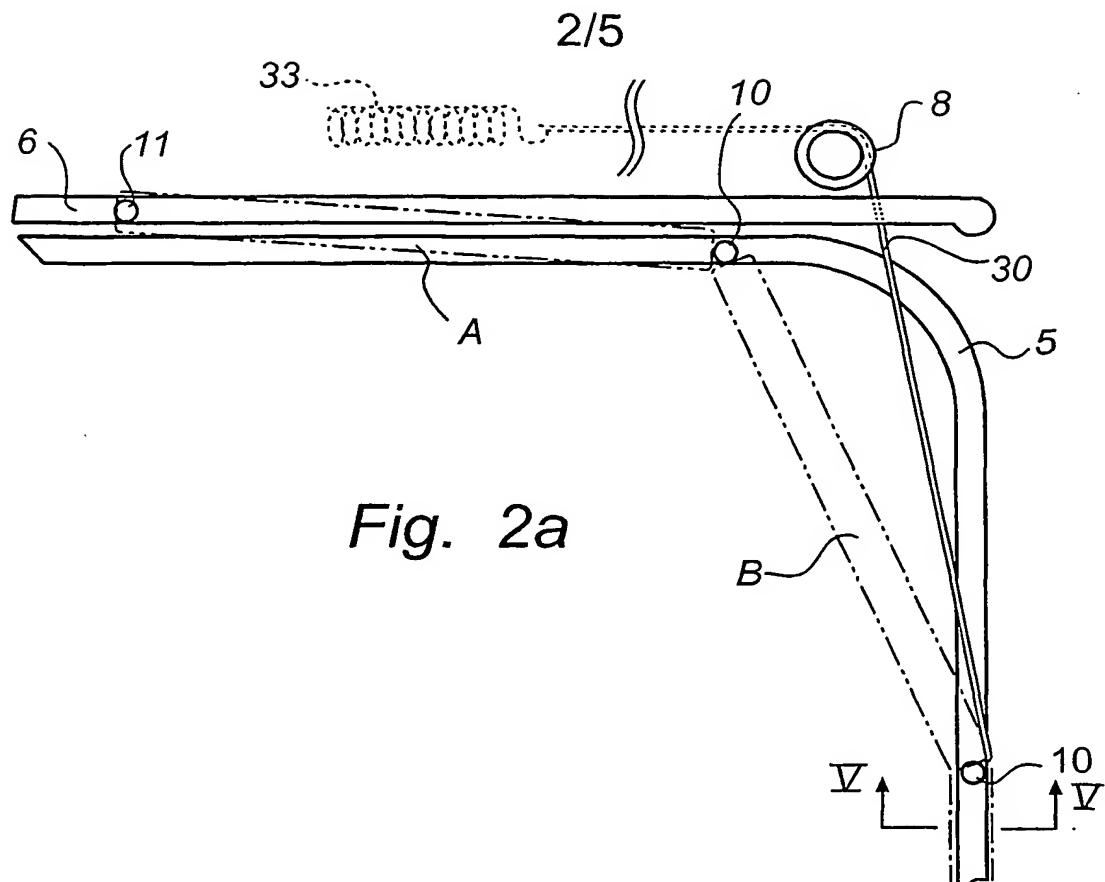


Fig. 2a

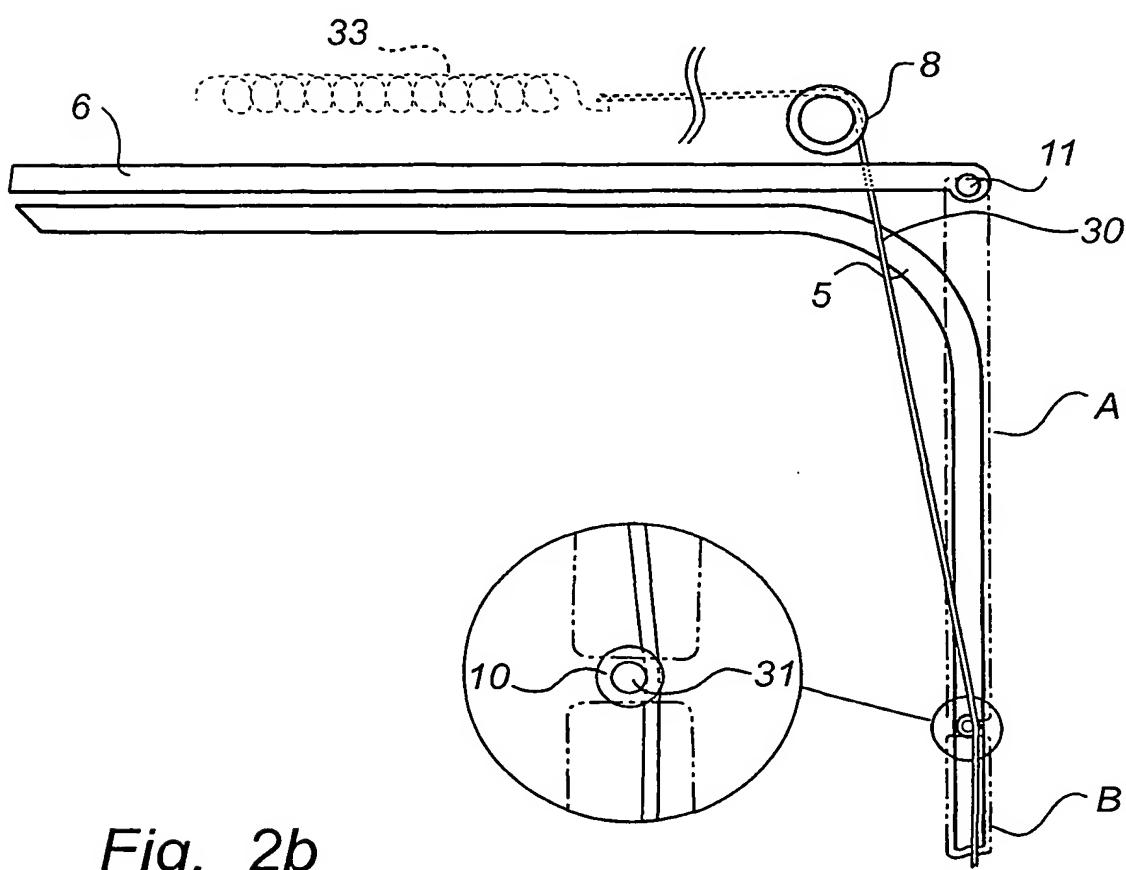


Fig. 2b

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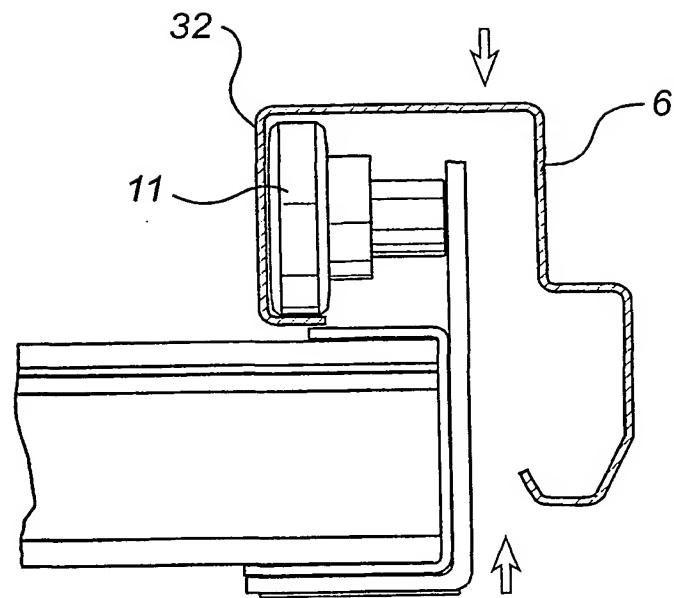


Fig. 3

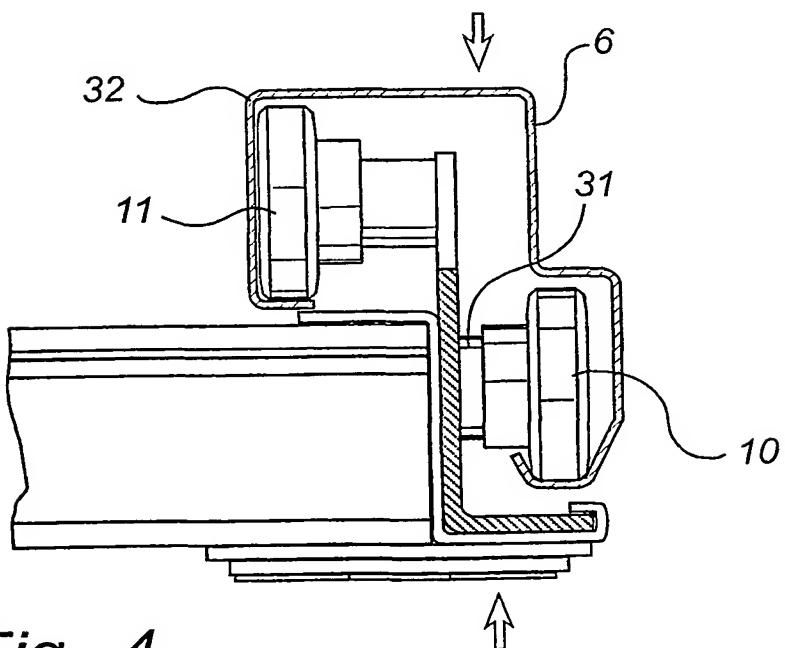


Fig. 4

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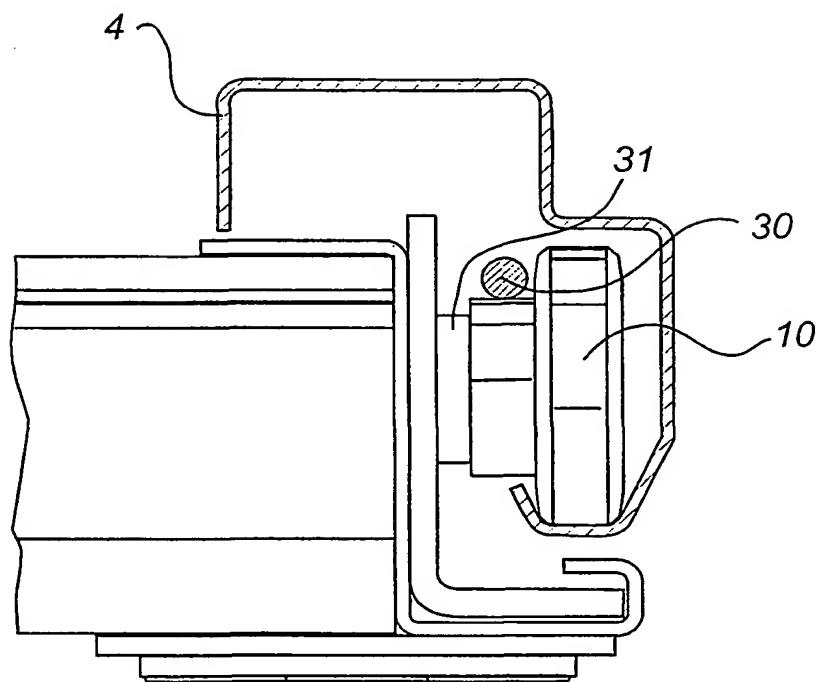


Fig. 5

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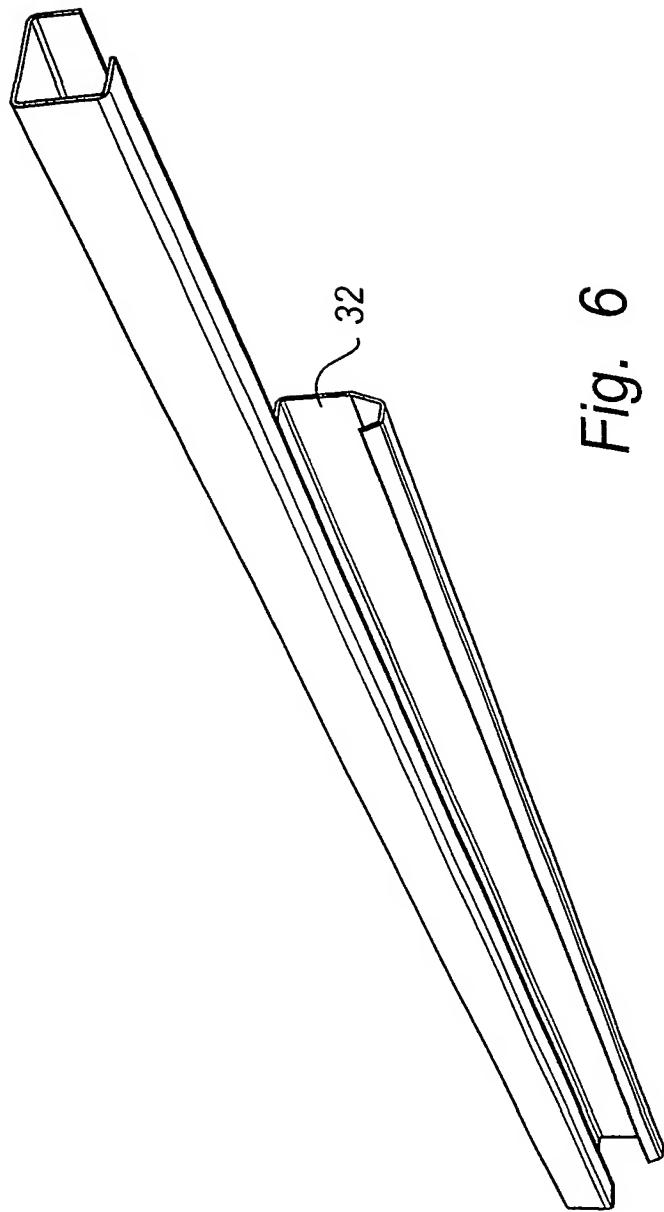


Fig. 6

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 02/00408

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: E06B 3/48**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: E06B, E05D**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5489130 A (RONALD L. CLARK), 6 February 1996 (06.02.96) --	1-11
A	US 5566740 A (WILLIS J. MULLET ET AL), 22 October 1996 (22.10.96) --	1-11
A	US 6073674 A (THOMAS J. HÖRMANN), 13 June 2000 (13.06.00) --	1-11
A	US 6076589 A (THOMAS J. HÖRMANN), 20 June 2000 (20.06.00) --	1-11

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 02/00408

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6082046 A (KEVIN A. SIMMONS), 4 July 2000 (04.07.00) --	1-11
A	US 6112799 A (WILLIS J. MULLET ET AL), 5 Sept 2000 (05.09.00) --	1-11
A	SE 505815 C2 (CARDO DOOR AB), 13 October 1997 (13.10.97) -- -----	1-11

Form PCT/ISA/210 (continuation of second sheet) (July 1998)

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 02/00408

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US	5489130	A	06/02/96	NONE	
US	5566740	A	22/10/96	AT 207183 T AU 700830 B AU 2372399 A AU 2372499 A AU 2705095 A DE 69523278 D,T EP 0722530 A,B SE 0722530 T3 EP 1108511 A EP 1108839 A EP 1108850 A US 5495640 A US 5522446 A US 5562141 A US 5836499 A US 6019269 A WO 9534738 A	15/11/01 14/01/99 17/06/99 17/06/99 05/01/96 18/04/02 24/07/96 20/06/01 20/06/01 20/06/01 05/03/96 04/06/96 08/10/96 17/11/98 01/02/00 21/12/95

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 02/00408

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 6073674 A	13/06/00	AT 186587 T CN 1207793 A CZ 9801989 A DE 19654164 A, C DE 29622370 U DE 59603642 D EP 0868587 A, B SE 0868587 T3 ES 2138404 T GR 3032012 T HU 9901936 A NO 310521 B NO 982915 A PL 181991 B PL 327191 A WO 9723700 A AT 203085 T CN 1215447 A CZ 9803104 A DE 19713457 A DE 19713458 A DE 59704016 D DK 890010 T EP 0890009 A EP 0890010 A, B SE 0890010 T3 ES 2158556 T HU 9901382 A NO 311649 B NO 984424 A PL 182883 B PL 329128 A PT 890010 T RU 2150562 C US 6122862 A WO 9737097 A WO 9737098 A DK 868587 T		15/11/99 10/02/99 11/11/98 10/07/97 30/04/97 00/00/00 07/10/98 01/01/00 31/03/00 28/10/99 16/07/01 11/08/98 31/10/01 23/11/98 03/07/97 15/07/01 28/04/99 17/03/99 20/11/97 20/11/97 00/00/00 24/09/01 13/01/99 13/01/99 01/09/01 30/08/99 27/12/01 12/11/98 29/03/02 15/03/99 31/10/01 10/06/00 26/09/00 09/10/97 09/10/97 08/05/00
US 6076589 A	20/06/00	CN 1216084 A, T CZ 9802882 A DE 19731932 A, C EP 1092074 A NO 310522 B NO 984039 A PL 328813 A WO 9830776 A		05/05/99 17/03/99 16/07/98 18/04/01 16/07/01 10/09/98 15/02/99 16/07/98
US 6082046 A	04/07/00	NONE		
US 6112799 A	05/09/00	AU 4085399 A WO 9960240 A		06/12/99 25/11/99

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 02/00408

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 505815 C2	13/10/97	AU 3268795 A	07/03/96
		SE 9402729 A	17/02/96
		WO 9605399 A	22/02/96

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